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Epigeic spiders of the pastures of northern Wielkopolska

Marek WOŹNY & Paweł SZYMKOWIAK

Abstract: The fauna of epigeic spiders (Araneae) occurring on three different types of pastures in northern Wielkopolska was analysed. Studies were conducted from May 1992 to October 1993. The 18,995 specimens collected were classified as belonging to 137 species and 17 families. The family Linyphiidae proved the richest in species while Lycosidae was the most abundantly in terms of number of specimens. Zoocenological analysis of spider communities showed their differentiation testifying to differences in the sites studied. The dominants were: 1) Osowo Stare (Site 1): *Pardosa palustris*, 2) Sycyn Dolny (Site 2): *Xerolycosa miniata*, *P. palustris*, *Xysticus kochi*, 3) Brączewo (Site 3): *Erigone dentipalpis*, *P. palustris*. Seasonal changes of dominance of the species at each site were established. A comparison of changes of the species' dominances in the years 1992 and 1993 disclosed similar values of the individual dominance coefficient at the sites in Osowo Stare and Brączewo. This result indicates the occurrence of the process of stabilization of these biocenoses and a tendency to equilibrium in the environment. The least stable proved to be the site at Sycyn Dolny. Analysis of the seasonal dynamics of epigeic spider communities was also made by determining the mean number of species at each site in the two years of study. The highest number of species was noted in spring. It is interesting to note the appearance of species which are rare or very rare in Poland such as: *Lepthyphantes insignis*, *Ostearius melanopygius*, *Enoplognatha mordax* and *Enoplognatha oelandica*.

Keywords: epigeic spiders, pasture, community and species ecology, Poland

INTRODUCTION

Data on spiders of meadows and pastures are relatively scarce in the literature. They can be found in works devoted to ecological problems reporting studies on syn- and autecology of meadow spiders (FLATZ 1986; KAJAK 1960, 1962, 1971, 1978; KAJAK et al. 1971; MARTIN 1991) and are sometimes mentioned in reports on the fauna of greater geographical complexes (geographical regions, national parks, natural areas). Frequent subjects of ecological works are interpopulation mechanisms, production and consumption and, among other things, they describe the interactions between the predator and its prey pointing to an important role for these animals in the preservation of a biocenotic equilibrium (BREYMEYER 1970;

KAJAK 1971; KAJAK et al. 1971; NENTWIG 1982). Recently, MERKENS (1997) has demonstrated a considerable effect of such environmental factors as soil humidity, vegetation height or cattle density on the spider community distribution on pastures.

This paper presents analyses of spider communities living in the surface layer of soil in three pastures of different physio-geographical conditions. The studies were performed in northern Wielkopolska, in the region belonging to Wielkopolska – Kujawy Lowland. The spiders of this region are well known. Recently, a few rare species have been added to the list of spiders from this region thanks to the studies of DZIABASZEWSKI (1989, 1991, 1995), DZIABASZEWSKI (1992), SZYMKOWIAK (1992, 1993) and SZYMKOWIAK et al. (1999). At present the list of known species numbers 490.

MATERIAL AND METHODS

Study sites

The three study sites lie in the vicinity of the town of Szamotuły, about 38 km to the north-west of Poznań (Fig. 1). The natural north and east border of the area of study is the valley of the River Warta. The area is slightly undulating with a mean height of 75-100 m above sea level. The rich sculpture of the earth surface was formed during the Poznań stage of the Baltic glaciation. Once the area was covered by oak-hornbeam forest (KONDRACKI 1988), but agrotechnical measures have exposed the land and led to the appearance of out-wash elevations and inland dunes. The exposed land has been transformed into fields, meadows and pastures.

Site 1 – Osowo Stare. This site lies 5 km to the north-east of Szamotuły within the borders of Osowo Stare village (Fig. 1). The site studied was an enclosed pasture from the Molinio-Arrhenatheretea class (MATUSZKIEWICZ 1984), lying at the top of Osowa Góra hill. The fertile pasture is vegetated with high clumps of spreading grasses with a significant contribution of rye-grass (*Arrhenatherum elatius*) and orchard grass (*Dactylis glomerata*). There are some bushes and irregularly growing hedgerows. The hill is, at certain spots, lowered and the ground there becomes rather swampy. At these spots the contribution of moss and rushes is increased. The transect was made on a drained hillside. There was no forestation in the close vicinity of the pasture.

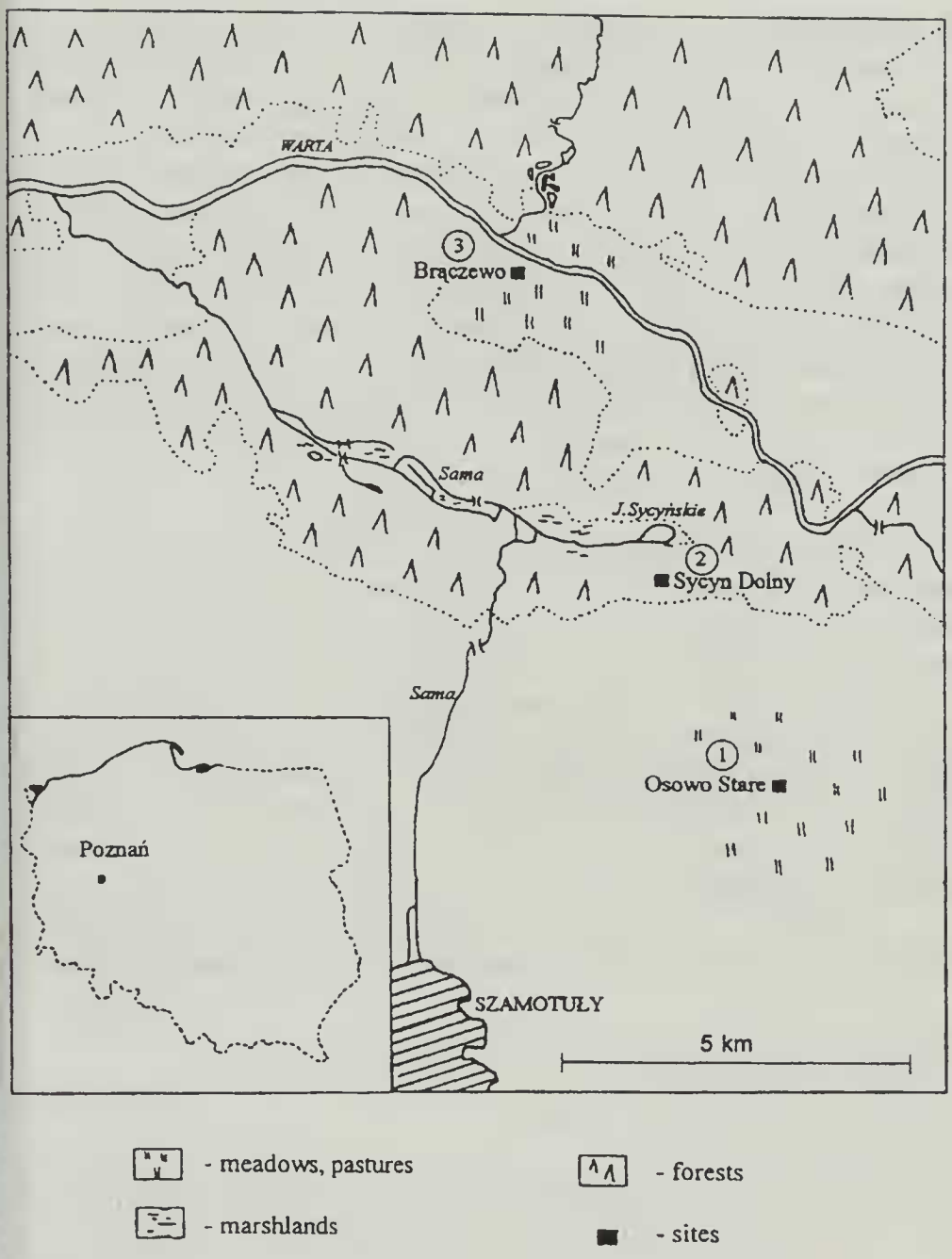

Fig.1: Location of the studied sites.

Site 2 – Sycyn Dolny. The site was located in Sycyn Dolny village, 8 km north of Szamotuły (Fig. 1). The pasture selected for the studies was in a large forest clearing. In its immediate neighbourhood there was an eutrophic lake (Sycyn Lake) partly covered with a growth, merging swamps. The clearing was surrounded by thick pine stands on dry ground. From the phytosociological point of view, the site is composed of different transient variants – from communities of the Corynephorerea class (MATUSZKIEWICZ 1984) to low sedge growth of Scheuchzerio-Caricetea fuscae class (SZOSZKIEWICZ 1971). Clumpy grass, with a considerable contribution of sedge, dominated in the lowered areas with a significant contribution of perennial growth on the sandy elevations. The site studied was chosen between the swamps and bogs of Sycyn Lake on one side and pine forest on the other. The transect was placed on a sandy fragment of the field.

Site 3 – Brączewo. The site lies on the banks of the River Warta in Brączewo village, about 12 km north of Szamotuły (Fig. 1). The site was situated on a 5 m high flood-terrace of highly mosaic growth with different transient variants of plant communities from the Molinio-Arrhenateretea class (MATUSZKIEWICZ 1984). The vegetation was dominated by low-spreading and clumpy grass, cinquefoil (*Potentilla* sp.) and yarrow (*Achillea millefolium*), with isolated aspen trees. The site studied lies on a dry, strongly sunlit fragment of a flood terrace along the banks of the River Warta, about 50 m from flood meadows. Throughout the period of the study no flooding of the site was observed.

Characteristic of all the above described sites were the following features:

a) extensive cattle grazing,
b) transects along the northern-southern direction,
c) location on elevated pieces of land,
d) good insolation.

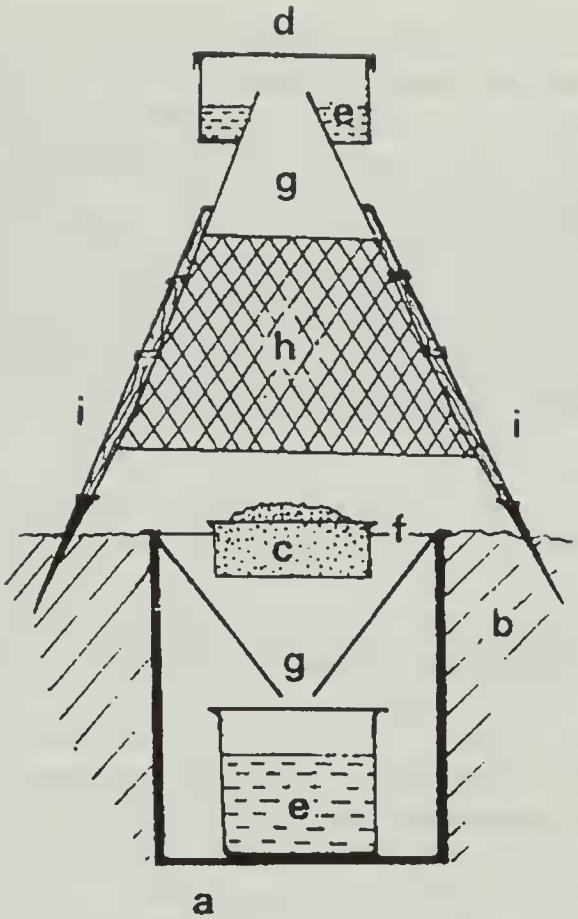

Fig. 2: Trap of "Didonis & Miller" (according to BUNALSKI 1991).
a – cylinder, b – soil, c – attracting substratum (dung), d – cover, e – preservation liquid, f – nylon net or lattice, g – funnel, h – sleeve, i – supports.

METHODS

Material was collected using modified pitfall traps of the "Didonis & Miller" type (BUNALSKI 1991) (Fig. 2). Traps were charged with a Leech's solution (water-etylene glycol-detergent mixture). Each trap consisted of an upper cone trap and a modified soil pitfall trap. Only the pitfall part was used for collecting coprophagic dung beetle (Scarabaeidae) and spiders. On each area studied there were 18 traps arranged in three rows of 6. The distance between rows was 100-120 cm and between traps in a row 150-180 cm. The studies were carried out in 1992 and 1993, in the season lasting from the beginning of May to the end of October. Transects were placed each year

at the same places. Samples were collected systematically every 7 or 8 days. Zoocenologic analysis of spider communities was carried out using the individual dominance index (*D*), defined as the percentage contribution of specimens of a given species to the total number of specimens of all species collected at a given site.

The following classes of individual dominance were assumed after GÓRNY & GRÜM (1981): D_5 – eudominants >10%, D_4 – dominants 5.1-10%, D_3 – subdominants 2.1-5%, D_2 – recedents 1.1-2%, D_1 – subrecedents < 1%.

Analysis of similarity was carried out on the basis of the formula of MARCZEWSKI & STEINHAUS (1959).

$$s = \frac{w}{a + b - w}$$

s – similarity of two collections compared with each other; *a* – number of individuals of species in collection A; *b* – number of individuals of species in collection B; *w* – number of individuals of species common to both collections.

Fidelity described the degree to with the species are bound to the habitat. On the basis of analysis of dominance we adopted 5 classes of fidelity that were distinguished by Peus (PETRUSEWICZ 1938; RAJSKI 1961; GÓRNY & GRÜM 1981). The classes are as follows:

a) characteristic species: exclusive and selective ones,
b) accompanying species: indifferent and attending ones,
c) accidental species.

The exclusive species are those appearing only in a given site/habitat whereas the selective ones are those which attain the highest value of dominance within a given site/habitat, though they can also occur, even regularly in other sites/habitats.

The nomenclature used (Tab. 1) follows that of PLATNICK (1993).

RESULTS

Faunal characteristics

The material collected at the studied sites is both quantitatively and qualitatively diversified, (Tab. 1). The total number of specimens (18,995) included 9,269 males, 5,509 females and 4,217 juveniles. The greatest number of specimens – 13,238 – was collected at the site in Osowo Stare and comprised 69.7% of all spiders collected at the three sites. At the sites in Sycyn Dolny and Brączewo the number of specimens collected was 3,073 and 2,683 respectively. The particularly high number of spiders found at site 1 in Osowo Stare was due to the abundance of *Pardosa palustris* which appeared in large numbers in May (3,504) and June (1,762). In the following months their number decreased: July – 160, August – 95, September – 3. A similar situation was noted at all three sites, i.e. the largest number of specimens was collected in May, slightly lower in June, much lower in July, August and September, with only single occurrences in October.

The most abundant species in examined material was *P. palustris* represented by 6,605 specimens which made up 34.7% of the total number of specimens found. There were 14 species whose individual contribution was lower but still significant, from 1 to 5%: *Erigone dentipalpis* – 4.9%, *Pardosa pullata* – 4.8%, *Pachygnatha degeeri* – 4.6%, *Xysticus kochi* – 3.8%, *Xerolycosa miniata* – 3.6%, *Pardosa prativaga* – 2.8%, *Pardosa agrestis* – 2.6%, *Xysticus cristatus* – 1.7%, *Erigone atra* and *Pardosa amentata* – 1.5% – each, *Alopecosa pulverulenta* – 1.3%, *Tiso vagans* – 1.2%, *Oedothorax fuscus* and *Pachygnatha clercki* – 1% – each. Their total contribution comprised about 36.3% of the specimens found. The presence of as many as 40 species was indicated by a single specimen, (Tab. 1). As much as 72% of the collected specimens belonged to the Lycosidae.

Table 1: Spider species collected at the three sites studied.

Species	Site 1		Site 2		Site 3		Months	Sex			Total
	1992	1993	1992	1993	1992	1993		M	F	Juv.	
PHOLCIDAE											
Pholcus opilionoides (Schrank, 1781)		1					VII	1			1
MIMETIDAE											
Ero furcata (Villers,1789)	1				1		VI, IX		1	1	2
Ero sp.			1				V			1	1
THERIDIIDAE											
Crustulina guttata (Wider, 1834)	1		3				V, VI	1	3		4
Enoplognatha latimana Hippa & Oksala, 1982	1						VII	1			1
Enoplognatha mordax (Thorell, 1875)	24	20					V - X	29	12	3	44
Enoplognatha oelandica (Thorell, 1875)			1	4			V, VI	1	4		5
Enoplognatha ovata (Clerck, 1757)					1		V			1	1
Enoplognatha thoracica (Hahn, 1833)	12	9	35	27	1	1	V, VI, IX	44	35	6	85
Robertus lividus (Blackwall, 1836)	2				1		V	3			3
Steatoda albomaculata (De Geer, 1778)				3			V, VIII	3			3
Steatoda bipunctata (Linnaeus, 1758)	1						VIII	1			1
Steatoda phalerata (Panzer, 1801)		1	2	13			V - VII	11	3	2	16
Therdion bimaculatum (Linnaeus, 1767)	4	1	1		1	1	V - VIII	2	4	2	8
Theridion impressum L. Koch, 1881			1	1			VI, IX	2			2
Enoplognatha sp.	13	7	6	4	2	2	V, VI, IX, X			34	34
Steatoda sp.			1	1			V, VII			2	2
Theridion sp.	1		2				V			3	3
LINYPHIIDAE											
Allomengea scopigera (Grube, 1859)					1		IX	1			1
Allomengea vidua (L. Koch, 1879)						1	IX		1		1
Araeoncus humilis (Blackwall, 1841)	3	4	1	2	2	9	V - X	18	3		21
Baryphyma pratense (Blackwall, 1861)	1				1		V, VI		2		2
Bathyphantes gracilis (Blackwall, 1841)	1				1	3	V, VIII	3	2		5
Centromerita bicolor (Blackwall, 1833)		9				1	V, IX, X	4	6		10

Centromerita concinna (Thorell, 1875)	16						VIII - X	9	7		16
Centromerus sylvaticus (Blackwall, 1841)	1						X		1		1
Dicymbium nigrum (Blackwall, 1834)	34		1		2		V - VII	8	29		37
Diplocephalus cristatus (Blackwall, 1833)	1						VI		1		1
Diplostyla concolor (Wider, 1834)		1		1	1	10	VII - X	4	9		13
Erigone atra Blackwall, 1833	23	58	9	17	66	106	V - X	170	109		279
Erigone dentipalpis (Wider, 1834)	61	60	6	8	232	564	V - X	622	309		931
Erigone longipalpis (Sundevall, 1830)	1				2	4	V, VIII, IX	1	6		7
Erigonella hiemalis (Blackwall, 1841)	10						V	3	7		10
Gnathonarium dentatum (Wider, 1834)	1		1				V		2		2
Gongylidiellum murcidum Simon, 1884		1	2			3	VI, VIII, X	4	2		6
Gongylidium rufipes (Linnaeus, 1758)	2						VI	2			2
Lepthyphantes insignis O. P.-Cambr., 1913	4	4	2	2		1	V - IX	9	4		13
Lepthyphantes mengei Kulczyński, 1887	2	1					VI, VIII	3			3
Lepthyphantes nebulosus (Sundevall, 1830)						1	IX	1			1
Lepthyphantes pallidus (O. P.-Cambr., 1871)						1	VII		1		1
Lepthyphantes tenuis (Blackwall, 1852)	1	2	1	1		7	VI - VIII, X	9	3		12
Meioneta rurestris (C.L. Koch, 1836)	2	7	23	29	17	30	V - X	75	33		108
Metopobactrus prominulus (O. P.-Cambr., 1872)				1			X		1		1
Micrargus herbigradus (Blackwall, 1854)	4		1				V, VI	5			5
Microlinyphia pusilla (Sundevall, 1830)	1	1	2	6		1	VI - VIII	11			11
Mioxena blanda (Simon, 1884)				1			X	1			1
Neriene clathrata (Sundevall, 1830)	4						V, VII, VIII	2	2		4
Neriene montana (Clerck, 1757)	1		1	1			V, X	1		2	3
Oedothorax apicatus (Blackwall, 1850)	4	1	5	1	5		V - VII, IX, X	8	8		16
Oedothorax fuscus (Blackwall, 1834)	1	80	4	1	3	111	V - X	148	52		200
Oedothorax retusus (Westring, 1851)	2					11	V, VIII - X	8	5		13
Ostearius melanopygius (O. P.-Cambr., 1879)	2	7	7	21	5	1	VI - X	19	21	3	43
Pelecopsis parallela (Wider, 1834)				9		4	VI - X	7	6		13
Pelecopsis radicicola (L. Koch, 1872)		1					X		1		1
Pocadicnemis juncea Locket & Millidge, 1953	9	1				1	V - VII	5	6		11

Table 1: Spider species collected at the three sites studied. - continued.

Species	Site 1		Site 2		Site 3		Months	Sex			Total
	1992	1993	1992	1993	1992	1993		M	F	Juv.	
Pocadicnemis pumila (Blackwall, 1841)	1				1		V, VII	1	1		2
Porrhomma pygmaeum (Blackwall, 1834)		1	1	2	3		V - IX	3	4		7
Savignia frontata (Blackwall, 1833)			1		3	3	V - VII	5	2		7
Stemonyphantes lineatus (Linnaeus, 1758)	8		1				V, X	5	4		9
Tiso vagans (Blackwall, 1834)	76	114	12	6	10	6	V - X	66	158		224
Trematocephalus cristatus (Wider, 1834)	1						V	1			1
Troxochrus scabriculus (Westring, 1851)	1	2			1		V, VI, VIII	4			4
Typhochrestus digitatus (O. P.-Cambr., 1872)			1				V		1		1
Walckenaeria atrotibialis (O. P.-Cambr., 1878)						1	VI	1			1
Walckenaeria kochi (O. P.-Cambridge, 1872)						1	V	1			1
Erigone sp.	3	13			2	10	V, VIII - X			28	28
TETRAGNATHIDAE											
Pachygnatha clercki Sundevall, 1823	171	2	4		12	11	V, VI, VIII - X	90	108	2	200
Pachygnatha degeeri Sundevall, 1830	484	104	83	7	78	127	V - X	396	438	49	883
Pachygnatha sp.	4	7		1	6	3	VI - X			21	21
ARANEIDAE											
Aculepeira ceropegia (Walckenaer, 1802)	1	1					VI	2			2
Araneus quadratus Clerck, 1757	1			2			VIII, X	1	2		3
Araniella cucurbitina (Clerck, 1757)						1	VI			1	1
Argiope bruennichi (Scopoli, 1772)			2				VI, VII	1		1	2
Mangora acalypha (Walckenaer, 1802)	2	1	1				V		1	3	4
Nuctenea umbratica (Clerck, 1757)					1		VIII			1	1
LYCOSIDAE											
Alopecosa barbipes (Sundevall, 1833)			4	1			VI, IX, X	2	3		5
Alopecosa cuneata (Clerck, 1757)	40	13	18				V, VII	32	39		71
Alopecosa pulverulenta (Clerck, 1757)	202	49	2		2		V - VIII	209	46		255
Alopecosa schmidti (Hahn, 1835)			23	2			V - X	22	3		25

Alopecosa trabalis (Clerck, 1757)		10					V	6	4		10
Arctosa perita (Latreille, 1799)	2		7	2			V, VI, X	2	6	3	11
Pardosa agrestis (Westring, 1862)	61	414	15	3		2	V - X	306	189		495
Pardosa agricola (Thorell, 1856)						2	V	1	1		2
Pardosa amentata (Clerck, 1757)	266	20	6	1	1	1	V - VIII	149	146		295
Pardosa monticola (Clerck, 1757)	2	1					VI, VIII		3		3
Pardosa palustris (Linnaeus, 1758)	2476	3048	298	279	71	433	V - IX	4133	2471	1	6605
Pardosa prativaga (L. Koch, 1870)	184	297	16	3	6	19	V - X	295	229	1	525
Pardosa pullata (Clerck, 1757)	498	380	29		1	8	V - IX	484	432		916
Pirata piraticus (Clerck, 1757)						1	V		1		1
Trochosa ruricola (De Geer, 1778)	139	106	16			3	V - X	195	69		264
Trochosa terricola (Thorell, 1856)	1						V	1			1
Xerolycosa miniata (C.L. Koch, 1834)	24	2	124	512	13	4	V - IX	445	213	21	679
Alopecosa sp.	7		6	11		9	V, VI, VIII, IX			33	33
Pardosa sp.	850	1480	303	137	165	235	V - X			3170	3170
Trochosa sp.	26	40	1	8	4	11	V - X			90	90
Xerolycosa sp.	21		72	54	18		V - X			165	165
PISAURIDAE											
Pisaura mirabilis (Clerck, 1757)	35	23	13	3	2	2	V - X	37	10	31	78
AGELENIDAE											
Tegenaria agrestis (Walckenaer, 1802)	14	10	8	16	2	5	V, VII - X	34	19	2	55
Tegenaria atrica C.L. Koch, 1843			1				IX	1			1
Tegenaria sp.					1		VII			1	1
LIOCRANIDAE											
Agroeca brunnea (Blackwall, 1833)			1				V	1			1
Phrurolithus festivus (C.L. Koch, 1835)				5	1	5	V, IX	1	10		11
Phrurolithus minimus C.L. Koch, 1839					2		VII, VIII	1	1		2
Phrurolithus sp.			1				VII			1	1
CLUBIONIDAE											
Cheiracanthium erraticum (Walckenaer, 1802)	1		6				V	4	1	2	7
Cheiracanthium virescens (Sundevall, 1833)			1	7		1	VI	7	2		9
Clubiona comta C.L. Koch, 1839	1						V	1			1

Table 1: Spider species collected at the three sites studied. - continued.

Species	Site 1		Site 2		Site 3		Months	Sex			Total
	1992	1993	1992	1993	1992	1993		M	F	Juv.	
Clubiona lutescens Westring, 1851	2	1					V, VI	2	1		3
Clubiona neglecta O. P.-Cambridge, 1862		1				1	V, VI	2			2
Clubiona pallidula (Clerck, 1757)	2						V, VII	1	1		2
Clubiona phragmitis C.L. Koch, 1843	1			1	1	1	V, VI, X	3	1		4
Clubiona reclusa O. P.-Cambridge, 1863	1	1	1		1		V	4			4
Clubiona similis L. Koch, 1867	3			1			V, VI	2	1	1	4
Clubiona sp.	2	1	3		1	3	V, VI, VIII - X			10	10
ZODARIDAE											
Zodarion germanicum (C.L. Koch, 1837)					1	3	VI, VII	3		1	4
GNAPHOSIDAE											
Drassodes pubescens (Thorell, 1856)	1			4			V	5			5
Drassyllus pusillus (C.L. Koch, 1833)	1	1	9	3		1	V - VII	11	4		15
Haplodrassus dalmatensis (L. Koch, 1866)				3			V, VI	1	2		3
Haplodrassus signifer (C.L. Koch, 1839)	2	4	5	8			V, VI	13	6		19
Micaria pulicaria (Sundevall, 1832)	4	1		1	8	5	V - IX	10	9		19
Scotophaeus quadripunctatus (Linnaeus, 1758)				2			V, VI	2			2
Zelotes aeneus (Simon, 1878)	1	1		2		2	VIII, IX	4	2		6
Zelotes electus (C.L. Koch, 1839)				1			VI	1			1
Zelotes latreillei (Simon, 1878)				1			X		1		1
Zelotes longipes (L. Koch, 1866)			2	1			VII, IX	3			3
Zelotes petrensis (C.L. Koch, 1839)				1			V	1			1
Zelotes subterraneus (C.L. Koch, 1833)	2		3				V, VIII	5			5
Haplodrassus sp.			1	2			VI, IX, X			3	3
Zelotes sp.	1			2		2	V, VII, VIII			5	5
ZORIDAE											
Zora spinimana (Sundevall, 1833)	4	2					V - VII	6			6
Zora sp.			1				V			1	1

PHILODROMIDAE											
Philodromus emarginatus (Schrank, 1803)					1		VI	1			1
Thanatus arenarius Thorell, 1872			10	4	1		V, VI	13	2		15
Thanatus striatus C.L. Koch, 1845			1				V	1			1
Tibellus oblongus (Walckenaer, 1802)	25	5	8	6	1	1	V - VII, IX, X	29	16	1	46
Philodromus sp.				2	1		V, VII, IX			3	3
Thanatus sp.			1				VIII			1	1
Tibellus sp.	5		8	1	2		V - IX			16	16
THOMISIDAE											
Ozyptila claveata (Walckenaer, 1837)	1						VI	1			1
Ozyptila praticola (C.L. Koch, 1837)		1					VI	1			1
Ozyptila trux (Blackwall, 1846)	4	3	1				V - VII	7	1		8
Xysticus audax (Schrank, 1803)		1					VI	1			1
Xysticus bifasciatus C.L. Koch, 1837				1			V	1			1
Xysticus cristatus (Clerck, 1857)	230	40	39	5	10	8	V - IX	273	58	1	332
Xysticus kochi Thorell, 1872	202	100	302	65	29	17	V - VII	636	79		715
Xysticus lanio C.L. Koch, 1835	1						VI		1		1
Xysticus ulmi (Hahn, 1831)	2				2	1	V	5			5
Ozyptila sp.	2		3				V - VIII			5	5
Xysticus sp.	114	189	109	29	31	7	V - X			479	479
SALTICIDAE											
Aelurillus v-insignis (Clerck, 1757)				1			V	1			1
Bianor aurocinctus (Ohlert, 1865)			1				VI		1		1
Heliophanus auratus C.L. Koch, 1835			1				VI	1			1
Pellenes tripunctatus (Walckenaer, 1802)				3			V, VI	3			3
Salticus scenicus (Clerck, 1757)		1					VI	1			1
Sitticus caricis (Westring, 1861)			2				VI, VII	2			2
Sitticus distinguendus (Simon, 1868)					6	3	V, VIII, IX	6	3		9
Sitticus floricola (C.L. Koch, 1837)		1					V		1		1
Sitticus zimmermanni (Simon, 1877)			1		1		VII, VIII	1	1		2
Heliophanus sp.	1						V			1	1
Sitticus sp.						2	VIII			2	2
Total	**6469**	**6769**	**1708**	**1366**	**848**	**1835**		**9269**	**5509**	**4217**	**18995**

Table 2: Characteristic species at the studied sites.

Fidelity	Site 1 (Osowo Stare)	Site 2 (Sycyn Dolny)	Site 3 (Brączewo)
Exclusive species	*Enoplognatha mordax* *Centromerita concinna* *Alopecosa trabalis*	*Enoplognatha oelandica* *Alopecosa schmidti*	*Sitticus distinguendus*
Selective species	*Dicymbium nigrum* *Lepthyphantes insignis* *Stemonyphantes lineatus* *Alopecosa cuneata*	*Enoplognatha thoracica* *Steatoda phalerata* *Ostearius melanopygius* *Arctosa perita* *Drassylus pusillus*	*Araeoncus humilis* *Bathyphantes gracilis* *Diplostyla concolor* *Erigone longipalpis* *Lepthyphantes tenuis* *Savignia frontata*

Fidelity

Among the less abundant species the characteristic ones, exclusive and selective, indicate the specific character of a site (Tab. 2).

The species found at the above-mentioned sites differ in the level of attachment to their habitats and in this respect the material is not homogeneous. Apart from epigeic species, the material from the traps also included web making spiders, and those living in the layer of grass and herbs, as well as other forms living in different types of habitats. They have been described as accidental.

Similarity

The largest number of species (92) was collected at site 1. At site 2 – 84 and at site 3 – 70. Among them 33 (23.8%) species were common for all sites. Similarities in the composition of the spider fauna species assessed according to the MARCZEWSKI & STEINHAUS formula for the three sites studied, do not exceed 50% and are: 43.3% for site 1 and site 3, 40.8% for site 1 and site 2, and 36.4% for site 2 and site 3. Accordingly, the faunistic composition is more similar between site 1 and site 3 than site 2, and there is less similarity between site 2 and site 3. Among the 33 species common to all sites there are the ones rich in specimens like: *P. palustris*, *P. pullata*, *P. degeeri*, *X. kochi*, *X. cristatus*, *E. dentipalpis*, *E. atra*, as well as those whose contribution in the total number of specimens found does not exceed 1%.

Quantitative and qualitative contribution of families at the studied sites

The total number of specimens collected at the three sites studied is 18,995, of which 14,920 were determined as belonging to 137 species of 17 families; the other specimens were 4,075 juvenile forms determined only to genera (Tab. 1). The list of families, with a specified number of species and their represented specimens is given in Tab. 3 (in terms of the actual numbers and percent contribution).

Table 3: The qualitative and quantitative contribution of species in the families collected.

	Family	Number of species [ind.]	Number of specimens [ind.]	Contribution of species [%]	Contribution of specimens [%]
1.	Pholcidae	1	1	0.7	0.01
2.	Mimetidae	1	2	0.7	0.01
3.	Theridiidae	12	173	8.7	1.15
4.	Linyphiidae	48	2'062	35	13.83
5.	Tetragnathidae	2	1'083	1.4	7.26
6.	Araneidae	6	13	4.4	0.09
7.	Lycosidae	17	10'163	12.3	68.12
8.	Pisauridae	1	78	0.7	0.52
9.	Agelenidae	2	56	1.4	0.37
10.	Liocranidae	3	14	2.2	0.09
11.	Clubionidae	9	36	6.5	0.24
12.	Zodaridae	1	4	0.7	0.03
13.	Gnaphosidae	12	80	8.7	0.54
14.	Zoridae	1	6	0.7	0.04
15.	Philodromidae	4	63	2.9	0.42
16.	Thomisidae	9	1'065	6.5	7.14
17.	Salticidae	9	21	6.5	0.14
	Total	**138**	**14'920**	**100.0**	**100.000**

As follows from the analysis, the dominant families at the three sites proved to be Linyphiidae and Lycosidae. The family Linyphiidae was represented by the greatest number of species (35.0%), while the family Lycosidae by the greatest number of specimens (68.1%). The families represented by the least number of species and specimens were: Pholcidae, Mimetidae, Pisauridae, Zodaridae and Zoridae. A few families were represented by a low number of specimens but a relatively large number of species: Araneidae, Agelenidae, Liocranidae, Clubionidae, Gnaphosidae, Philodromidae and Salticidae, however, the contribution of representatives of these families did not exceed 1% of the total number of specimens (Tab. 3).

Dominance structure of spider communities at the studied sites

Site 1 – Osowo Stare. The site in Osowo Stare was very rich in spider species. 10,451 specimens representing 92 species were found there.

The class of eudominants is represented by one species *P. palustris*. The individual dominance index of this species is over 6 times higher than the value for the next two most abundant species *P. pullata* and *P. degeeri*. The class of subdominants comprised 7 species whose common contribution is 22% among the specimens from the community. The contributions of the recedent and subrecedent species are 4.6% and 6.6%, respectively. It is worth noting that the classes of eudominants, dominants and subdominants include 10 species of which 7 belong to the Lycosidae family and the specimens represented constitute 77.7% of all specimens collected at this site, (Tab. 4). Accordingly, the family Lycosidae plays the most important role in the activity of spiders of this locality. The situation is analogous with the species from the family Linyphiidae in the class of subrecedents, where of 79 species of this class 34 belong to this family. It is probable that the appearance of a large number of species from this group is related to migration from neighbouring biotopes.

Site 2 – Sycyn Dolny. The 2,303 specimens collected at site 2 represented 82 species. Although the number of specimens was 4.5 times lower than those found in Site 1, their qualitative composition was similar – there were only 10 less species represented at the site in Sycyn Dolny.

The contribution of species of higher indices of dominance was small; there were 3 eudominants, no dominants, 3 subdominants. The percent contribution of eudominants was 68.5%. The class of recedents included 4 species, among them an interesting one – *Ostearius melanopygius* which is rarely collected in Poland. The majority of species (72), belonged to the class of subrecedents (Tab. 4).

Table 4: Dominance structure at the studied sites.

Dominance structure	Site 1 (Osowo Stare)	D [%]	Site 2 (Sycyn Dolny)	D [%]	Site 3 (Brączewo)	D [%]
Eudominants	*Pardosa palustris*	52.8	*Xerolycosa miniata*	27.6	*Erigone dentipalpis*	36.7
			Pardosa palustris	25.0	*Pardosa palustris*	23.3
			Xysticus kochi	15.9		
Dominants	*Pardosa pullata*	8.4			*Pachygnatha degeeri*	9.5
	Pachygnatha degeeri	5.6	no dominants		*Erigone atra*	7.5
					Oedothorax fuscus	5.3
Subdominants	*Pardosa prativaga*	4.6	*Pachygnatha degeeri*	3.9	*Meioneta rurestris*	2.2
	Pardosa agrestis	4.5	*Enoplognatha thoracica*	2.7	*Xysticus kochi*	2.1
	Xysticus kochi	2.9	*Meioneta rurestris*	2.2		
	Pardosa amantata	2.7				
	Xysticus cristatus	2.6				
	Alopecosa pulverulenta	2.4				
	Trochosa ruricola	2.3				
Recedents	*Tiso vagans*	1.8	*Xysticus cristatus*	1.9	*Pardosa prativaga*	1.2
	Pachygnatha clercki	1.6	*Pardosa pullata*	1.2	*Pachygnatha clercki*	1.1
	Erigone dentipalpis	1.2	*Ostearius melanopygius*	1.2		
			Erigone atra	1.1		
Subrecedents	79 species		73 species		60 species	

Site 3 – Brączewo. The 2,166 specimens collected at this site represented 69 species, as follows from these numbers this site was much poorer both from the quantitative and qualitative points of view. Similarly, as at sites 1 and 2, the greatest quantitative contribution comes from the species belonging to the class of eudominants: *E. dentipalpis* and *P. palustris* (Tab. 4). They constitute 60% of all specimens collected at this site.

As follows from analysis of dominance structure at all sites there were altogether 4 eudominants: *P. palustris*, *X. miniata*, *X. kochi*, *E. dentipalpis*, 4 dominants: *P. degeeri*, *P. pullata*, *E. atra*, *Oe. fuscus*, and 10 subdominants: *P. prativaga*, *P. agrestis*, *P. amentata*, *X. kochi*, *X. cristatus*, *A. pulverulenta*, *T. ruricola*, *P. degeeri*, *E. thoracica*, *M. rurestris*.

Mean number of species at particular sites

In spring (May, June) the fauna of epigeic spiders was represented by the highest number of species. In the beginning of summer (July, the beginning of August) their abundance significantly decreased to remain at a constant low level through the end of summer and the beginning of autumn (Fig. 3).

The most pronounced differences in the mean number of species at the sites studied occurred in the months from May to July. In this period the largest number of species was collected in Osowo Stare with the lowest in Brączewo. In September and October the number of species at all sites was similar.

DISCUSSION AND CONCLUSIONS

The most abundant species at all sites proved to be *P. palustris* (34.8%), whereas the indices of individual contribution of the next 14 species ranged from 1 to 5%. The greatest number of species resulted from single specimens (Tab. 1). Such a large difference in abundance between *P. palustris* and the 14 less abundant species, and even larger differences between the former and the species represented by single specimens, should be interpreted as only partly reflecting the relationships in dominance structure of spiders of the biotopes studied. This result is also partly a consequence of the methodology applied, i.e. a selectivity of the pitfall traps used. The pitfalls selectively collect males and running forms, which was confirmed by the composition of the collected material. The number of males (9,269 ind.)

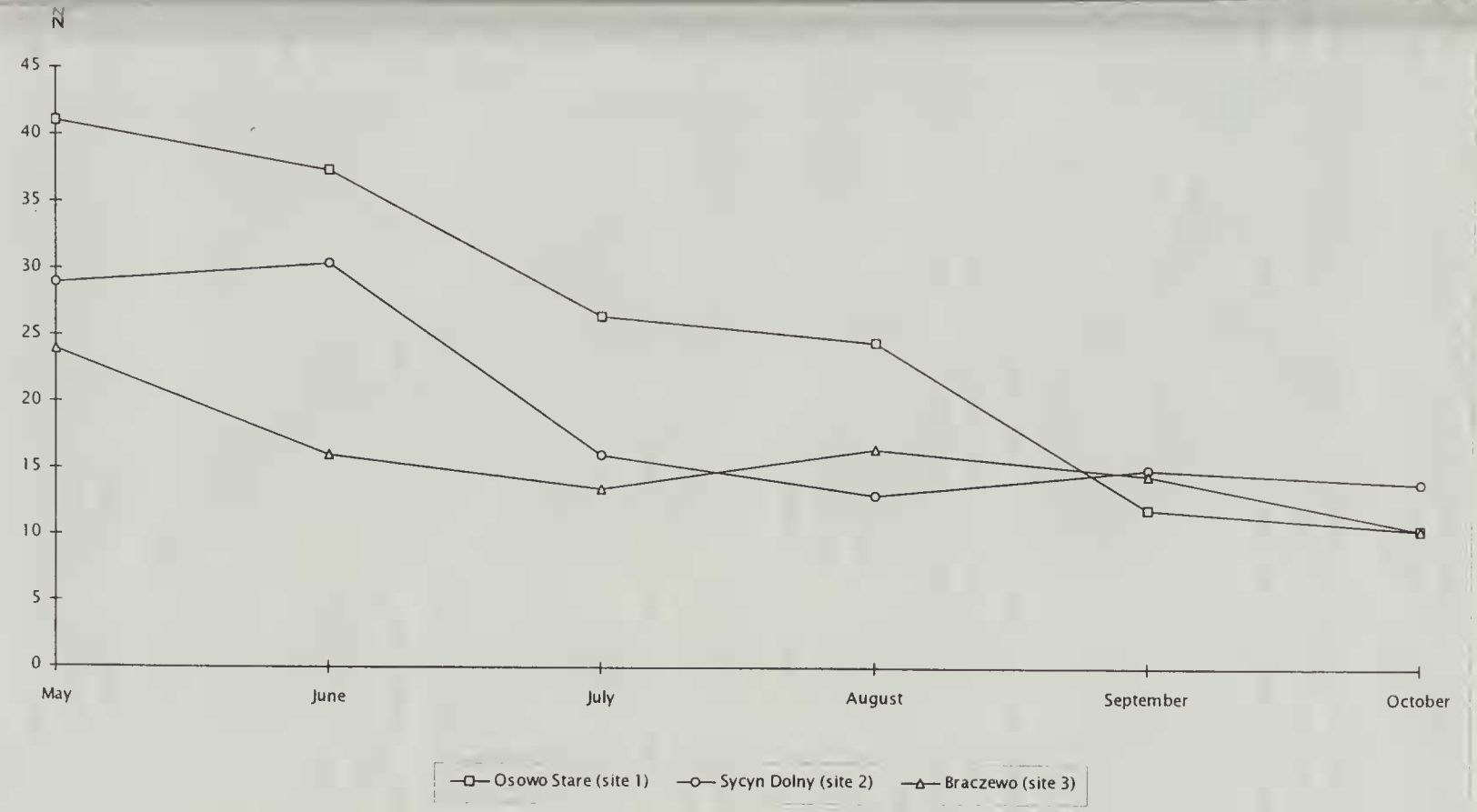

Fig. 3: Mean number of species at each of the sites calculated for the two years of study.
N - number of species

was much higher than that of females (5,509 ind.), and the representatives of the family Lycosidae (running forms) made up 72% of the material collected.

Zoocenological analysis of spider communities occurring at the sites studied pointed to their differentiation testifying to the different character of the sites. The differences are evidenced by the indices of individual dominance of particular species at particular sites. The species dominant in pastures of northern Wielkopolska included: *P. palustris*, *X. miniata*, *X. kochi*, *E. dentipalpis*, *P. degeeri*, *P. pullata*, *E. atra*, *Oe. fuscus*. Similar results were reported by STAREGA (1989) who studied the spider fauna of moist meadows. He proved a significant domination of the majority of the above mentioned spider species. According to his results only *X. miniata* and *X. kochi* were low-abundant species (subrecedents). The high dominance of these species in our studies was observed only at site 2 (Tab. 4), where the habitat conditions (sandy forest clearing) favoured their occurrence. *X. miniata* prefers dry, strongly sunlit and sandy kinds of habitats and *X. kochi* – the litter of dry pine forest (PRÓSZYŃSKI & STAREGA 1971). A great dominance of *E. atra*, *E. dentipalpis*, *Oe. fuscus* was noted at site 3. The first two belong to common aeronauts of agricultural land (THALER 1990) and their appearance could be explained by high possibilities of air dispersal. The site lies close to a river on a high flood-terrace and in a deforested area, so is easily accessible to spiders flying on gossamer threads. *E. dentipalpis* is an eurytopic species living in many different kinds of habitats, at different altitudes and in litter of different degrees of humidity, while *E. atra* is most often encountered on water plants (PRÓSZYŃSKI & STAREGA 1971). It has been reported as a dominant species in fields under cultivation (CZAJKA & KANIA 1976). This site offers favourable abiotic conditions for *Oe. fuscus* too, which prefers wet meadows situated close to water reservoirs (PRÓSZYŃSKI & STAREGA 1971).

Eudominants, dominants, subdominants and recedents constitute a constant composition of spider communities living in meadows and pastures near Szamotuły. The subrecedents, so abundantly represented in the material collected (Tab. 4), are unstable components of these communities.

The material studied also included species whose habitat is not directly related to the upper surface of pasture soil, and these species were classified into a few habitat groups:

a) spiders living in meadows and pastures (*Tibellus oblongus*, *Theridion bimaculatum*, *Microlinyphia pusilla*, *Aculepeira ceropegia*, *Araneus quadratus*, *Araniella cucurbitina*, *Argiope bruennichi*, *Mangora acalypha*, *Pisaura mirabilis*),

b) spiders living in wet habitats, on the banks of water reservoirs, and in high grass, reeds, bushes and trees (*Clubiona lutescens*, *Clubiona neglecta*, *Clubiona pallidula*, *Clubiona phragmitis*, *Clubiona reclusa*),

c) epigeic spiders living in sunlit and dry forests (*Drassodes pubescens*, *Haplodrassus signifer*, *Micaria pulicaria*, *Zelotes aeneus*, *Zelotes electus*, *Zelotes latreillei*, *Zelotes longipes*, *Zelotes petrensis*, *Zelotes subterraneus*, *Metopobactrus prominulus*),

d) epigeic spiders living in moss and litter of different types of forests (*Crustulina guttata*, *Robertus lividus*, *Lepthyphantes pallidus*, *Micrargus herbigradus*, *Pelecopsis parallela*, *Erigonella hiemalis*),

e) spiders living among herbs, on bushes, trees, in forests, gardens, parks etc. (*Philodromus emarginatus*, *Enoplognatha latimana*, *Enoplognatha ovata*, *Theridion impressum*, *Lepthyphantes mengei*, *Neriene clathrata*, *Trematocephalus cristatus*),

f) spiders preferring buildings, rarely encountered in natural habitats under bark or in rock crevices; DZIABASZEWSKI (1995) describes these species as hemisynantropes (*Pholcus opilionoides*, *Steatoda bipunctata*, *Lepthyphantes nebulosus*, *Neriene montana*, *Nuctenea umbratica*, *Scothophaeus quadripunctatus*).

It is supposed that the majority of the above mentioned accidental species wandered from surrounding biotopes and some of them reached the relevant sites by way of gossamer thread.

Interestingly, the material also contained a few species rare in Poland:

– *Haplodrassus dalmatensis* – 3 specimens (1 female, 2 males) were found in the material from Sycyn Dolny. It is the second recorded site in Wielkopolska – Kujawy Lowland; MIEDZIŃSKI (1934) found it near Krotoszyn, and then its presence was confirmed by STAREGA (1972, 1978) who found it in Poland in Małopolska Lowland (Krzyżanowice) and from Mazury Lake District (Turtuk near Suwałki).

– *Thanatus striatus* – only a single male specimen was caught at the site in Sycyn Dolny; it is the second recorded site of this species in Wielkopolska – Kujawy Lowland, MIEDZIŃSKI (1934) found it near Krotoszyn. It is a rare species, living in sandy habitats, STARĘGA (1983) reported two sites for the species in vicinity of Warsaw and Piła in Poland.

– *Leptyphantes insignis* – 13 specimens were caught (9 females, 4 males) at all sites studied. DZIABASZEWSKI (1989, 1995) caught a single female in an untypical environment on the wall of an old fortification in Poznań. It was previously considered as a rare species but with the use of Barber traps, the number of sites has considerably increased. It has been observed on fine webs in corridors and burrows of small rodents.

– *O. melanopygius* was recorded at all sites studied with 43 specimens (19 females, 21 males, 3 juvenile forms). In Poland it was reported for the first time by DZIABASZEWSKI (1979). According to a personal communication from Dr F. ZBYTEK, in the Czech Republic this species is found in great numbers in old hay stacks in the fields. In Poland it is still a rarely caught species.
– *Enoplognatha mordax* – 44 specimens (29 females, 12 males, 3 juvenile forms) were found at the site in Osowo Stare. It is a rare species, previously reported from the vicinities of Lublin, Tarnobrzeg and Warsaw (STARĘGA 1983).
– *Enoplognatha oelandica* – 5 specimens (1 female, 4 males) were caught at the site in Sycyn Dolny. In the fauna of Poland it is a very rare species, reported by STARĘGA (1974, 1978) from Wapnica on Wolin Island, and Toruń where it was found in xerothermic grass and a lawn.

The material collected has been divided as follows:
1. Proper epigeic spiders which are a constant element of overground forms of meadows and pastures, a group comprising Lycosidae and the dominant species, their quantitative contribution is over 60% without juvenile forms.
2. Accidental spiders, a qualitatively large group of exchangeable species (about 80%) usually occurring in low numbers, coming from bordered biotopes or as areonauts.

In general, communities of epigeic spiders in the pastures studied are characterized by a low number of constant species occurring in large numbers, and a large number of exchangeable species represented by low numbers, sometimes single specimens. ŁUCZAK (1997) proved that such species may change from year to year depending on weather and other abiotic and biotic factors.

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Marek WOŹNY, University of Wrocław, Department of Zoology, Sienkiewicza 21, PL-50-335 Wrocław

Paweł SZYMKOWIAK, A. Mickiewicz University, Department of Animal Taxonomy and Ecology, Szamarzewskiego 91 A, PL-60-569 Poznań
e-mail: szymkowi@main.amu.edu.pl